Chapter 1.17
Ontologies and E-Learning:
How to Teach a Classification

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EDITORS' NOTES

Matteo is from the University of Verona, where among other activities, he runs the Formal Ontologies Meet Industry (FOMI) event (see http://fandango.cs.unitn.it/fomi/). His expertise in ontologies is profound, and his contribution to the field is important. His argumentations in this chapter can help readers understand a number of crucial issues about the adoption of learning within organizations through ontologies and Semantic Web technologies. Moreover, this chapter answers the frequently asked question: What is an ontology?

The chapter discusses an emergent topic from another point of view. Ontologies provide a key layer for SW. Several workshops, special issues (http://www.ifets.info/), and tracks (http://www2005.org/papers/education.html) discuss the role of ontologies and the Semantic Web within e-learning. Recently, we undertook with Wolfgang Nejdl, Nicolas Balecheff and Joseph Hardin a special issue in the British Educational Technology Journal on the same theme to be published in early 2006. For furth information, visit the BJET Web site of BJET at http://www.blackwellpublishing.com/journal.asp?ref=0007-1013.

We believe that you will find Matteo's position chapter quite informing. We would be happy to receive comments on the theme of teaching ontologies.

ABSTRACT

What is an ontology? Why is this relevant to a learning environment? It is quite well established in recent investigations on information systems that formal ontologies are a crucial problem to deal with, and in fact, received a lot of attention in several different communities, such as knowledge management, knowledge engineering, natural language processing, intelligent information integration, and so on (Fensel, 2000). Ontologies have been developed in artificial intelligence to facilitate knowledge sharing and reuse. The viewpoint we adopt here is taken from the general considerations on the use of philosophical issues

in artificial intelligence: "the systematic, formal, axiomatic development of the logic of all forms and modes of being" (Cocchiarella, 1991). Another commonly accepted definition is that an ontology is an explicit specification of a shared conceptualization that holds in a particular context.

INTRODUCTION

The actual topic of ontology is one of those themes that epistemology (theories on knowledge) dealt with in philosophical studies of Parmenides, Heraclitus, Plato, Aristotle, Kant, Leibnitz, Wittgenstein, and others.

Ontologies define the kind of things that exist in the world and, possibly, in an application domain. In other words, an ontology provides an explicit conceptualization which describes semantics of data, providing a shared and common understanding of a domain. From an AI perspective we can say that:

...ontology is a formal explicit specification of a shared conceptualization. Conceptualization refers to an abstract model of phenomena in the world by having identified the relevant concepts of those phenomena. Explicit means that the type of concepts used and the constraints on their use are explicitly defined. Formal refers to the fact that the ontology should be machine-readable. Shared reflect that ontology should capture consensual knowledge accepted by the communities. (Gruber, 1998)

And moreover:

An ontology may take a variety of forms, but necessarily it will include a vocabulary of terms, and some specification of their meaning. This includes definition and an indication of how concepts are inter-related which collectively impose a structure on the domain and constrain the possible interpretation of terms. (Jasper & Ushold, 1999)

Nowadays, ontologies:

- Are used to allow communication among people and heterogeneous and widely spread application systems;
- Are implied in projects as a conceptual model, to enable a content-base access on corporate knowledge memories, knowledge bases, archives;
- Allow agents to understand each other when they need to interact, communicate, and negotiate meanings; and
- Refer to a common piece of information and share common understanding of the information structure.

In other words, ontologies provide *qualitatively new* levels of services in several application domains such as the Semantic Web (Ding & Foo, 2002) or federated databases. They enable reuse of domain knowledge, make domain assumption explicit, and separate domain knowledge from the operational knowledge.

One of the first steps in ontology creation is choosing domains and categories, which allow the correct representation. In particular, philosophers have tried to define very general and universal categories, which are supposedly able to describe the real world. The main idea is to develop an understandable, complete, and sharable system of categories, labels, and relations, which represent, in an objective way, the real world.

For instance, one of the interesting results achieved by Aristotle is the definition of general categories used to describe the main features of events, situations, and objects in the worlds: quality, quantity, activity, passivity, having, situated, spatial, and temporal. Kant figured out only four macro-categories used to describe the world: quantity, quality, relation, and modality.

Unfortunately, in the "real world" or in "practical applications" (i.e., information systems, knowledge management systems, portals, and other ICT applications), these general and uni-